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METHOD FOR SEPARATION OF GERM OF CORN

Claim

1. A method for the separation of germ of corn, characterized in that, an aqueous suspension of ground whole corn without steaming/boiling is subjected to an alcoholic fermentation by addition of carbohydrase and enzyme thereto and the germ floating on the upper surface of the fermented liquid is collected by filtration.

Detailed Description of the Invention

The present invention relates to a method for the separation of germ parts from whole corn. Germ of corn contains a lot of oil and protein and is useful as a material for edible oil such as salad oil and cooking oil. Most of the conventional methods for the separation of germ from corn are by a wet grinding method. In the wet grinding method, it is necessary during the course of dipping of whole corn in water that about

0.1 to 0.3% of anhydrous sulfurous acid is added for the purpose of sterilization, improvement in the recovery rate, etc. and it is also necessary to heat at 40°C or higher. After the dipping, water is separated, the corn is ground and suspended in water again and the germ is separated by means of difference in specific gravity, washed with water, dehydrated and dried. On the other hand, residual starch after separation of the germ is further ground, a refuse, etc. are separated therefrom and then washing with water, etc. are conducted to give pure corn starch. Alternatively, it is subjected to a liquefaction or saccharification step to give corn syrup, glucose and invert sugar.

The germ separated by such a conventional method is treated with a lot of sulfurous acid at high temperature and, therefore, the material oil prepared from germ or, in other words, corn oil contains much free fatty acids. In addition, the conventional method needs much water, heat and motive power. The present invention provides a method for the separation of germ which is entirely different from the conventional method as such and it relates to a method for the separation of germ of corn, characterized in that, an aqueous suspension of ground whole corn without steaming/boiling is subjected to an alcoholic fermentation by addition of carbohydrase and enzyme thereto and the germ floating on the upper surface of the fermented liquid is collected by filtration.

It is necessary that the ground whole corn in the present invention is not finely ground and, preferably, it is ground to an extent of about 1,680 to 420 μ. Such a ground product may be mixed with water in a weight ratio of about 1:3.4 to 1:1.8 to prepare a suspension. Water may be mixed with a waste liquid of alcohol distillation or all of the water may be the waste liquid of the distillation. Carbohydrase and enzyme are added to such a suspension without steaming/boiling and fermentation is carried out at 25 to 35°C. The present inventors have already disclosed various modes of the alcoholic fermentation method without steaming/boiling. Thus, it is preferred to use a carbohydrase preparation derived from *Rhizopus* as a main preparation and it is preferred that, during the first 10 hours of the fermentation, numbers of the enzyme are kept at 2×10^7/ml or more. When a material which is polluted with bacteria is used, anhydrous sulfurous acid in a few amounts (320 ppm or less) may be added thereto. In the alcoholic fermentation without steaming/boiling as such, the germ part is carried by carbon dioxide gas generated therein and is floated on the upper surface and, therefore, it may be taken out from the upper surface by means of filtration. The filtration may be carried out at any time during the fermentation and, in view of the handling, it is preferred to do that during the first half period of the fermentation. In the alcoholic fermentation method without steaming/boiling

developed by the present inventors, the fermentation period is 90 to 120 hours and, therefore, it is suitable for the operation to collect it by means of filtration within 60 hours or earlier from the initiation of the fermentation.

In the conventional fermentation method where alcoholic fermentation is carried out by steaming/boiling of an aqueous suspension of ground whole corn, the material is subjected to liquefaction and saccharification by heating and, therefore, the germ is not floated on the upper surface but is present together with saccharified refuse, enzyme, etc. whereby it is difficult to separate the germ only.

The germ which is separated by the method of the present invention may, if necessary, be washed with water and dried and, the same as in the germ separated by the conventional wet grinding, it is able to be used as a material for the manufacture of corn oil or gluten. Particularly, since the germ which is separated by the present invention is treated under the condition where a sulfurous acid concentration is 320 ppm or less even when a material significantly polluted with bacteria is used, the resulting germ is in a natural state as compared with the germ prepared by the conventional wet grinding method where sulfurous acid concentration is 0.1 to 0.3%. Accordingly, the corn oil manufactured from the germ prepared by the present invention has a characteristic that antioxidant ability is strong and free fatty acid is little and is excellent

as a material for edible oil as well.

In addition, in accordance with the separation by the conventional wet grinding method using the difference in specific gravity, it is difficult to confirm during the separation step whether the germ is completely separated or whether starch and others are accompanied therewith. In the method of the present invention however, most of starch is converted to alcohol, impurities such as the husk are precipitated with the enzyme and only germ is floated on the upper surface whereby there is a characteristic that the germ is able to be completely separated with very few contaminants. Accordingly, there are advantages that the after-treatment after the separation is very easy and that the yield of the separation is high. Moreover, unlike the conventional method, there is an excellent advantage that much water and heat are not used. The present invention will now be illustrated in detail by way of the following Examples. The yield used here is calculated by the following formula.

[Weight of germ (on the basis of water-free one)] / [Weight of whole corn (on the basis of water-free one)] × 100 (%)

Example 1

Whole corn (2.4 kg) ground to the following sizes, 8.4 units of glucoamylase derived from *Rhizopus* (JIS K 7001-1972) per gram of the material, 4.8 liters of water and 0.7 liter of yeast (*Saccharomyces cerevisiae*) were placed in a 10-liter

tank, mixed with stirring and fermented at 28°C for 112 hours.

Particle size of 1680 to 840 μ: 69.0%

Particle size of 840 to 420 μ: 16.5%

Particle size of smaller than 420 μ: 14.5%

(in accordance with JIS K 8801-1966)

After 24 hours from initiation of the fermentation, the germ floating on the upper layer of the fermentation liquid was scooped up with a net, washed with water and dried to give 154.8 g (containing 3% of water) of germ where the yield was 7.5%. On the other hand, analytical result after completion of the fermentation was as follows.

pH: 4.9; TA (total acids): 3.1; alcohol: 14.2%; FE (fermentation efficiency): 87.0%

Example 2

Whole corn (3.0 kg) ground to the following sizes, 5.5 units of glucoamylase derived from *Rhizopus* per gram of the material, 10.2 liters of water and 620 ml of *shubo* (yeast starter for a batch of sake) were placed in a 15-liter tank, mixed with stirring and fermented at 35°C for 92 hours.

Particle size of 1680 to 840 μ: 30.0%

Particle size of 840 to 420 μ: 34.1%

Particle size of smaller than 420 μ: 35.9%

After 48 hours from initiation of the fermentation, the germ part floating on the upper layer of the fermentation liquid was collected by filtration, washed with water and dried to

give 186.1 g (containing 3% of water) of germ where the yield was 7.4%. On the other hand, analytical result after completion of the fermentation was as follows.

pH: 4.7; TA (total acids): 3.5; alcohol: 9.4%; FE: 87.5%

Referential Example 1

Material oil (48 g) was manufactured by a compression-extraction method from 100 g of the germ prepared in Example 1. Amount of the free fatty acids in the material oil was 1.5% calculated as oleic acid.

Referential Example 2

To 100 g of the germ prepared in Example 2 was added 100 ml of n-hexane, dipping was conducted for 12 hours by heating at about 60°C and the resulting micelle (a mixed solution of fat/oil with solvent) was collected. To the germ wherefrom the micelle was removed was newly added 50 ml of n-hexane, dipping was conducted in the same manner, the micelle was collected therefrom and such an operation for the extraction of fat/oil was repeated for four times. All of the micelle prepared by such an extracting operation for fat/oil was placed in a distilling apparatus equipped with a jacket and heated at 90 to 100°C for 2 hours together with blowing of nitrogen thereinto to remove the solvent whereupon 51 g of corn material oil was prepared. Amount of free fatty acids in the material oil calculated as oleic acid was 1.4%.

[End]